

# sPHENIX Beam Test Joint Energy Scan Calibration and Resolution

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# Calibrate outer HCAL

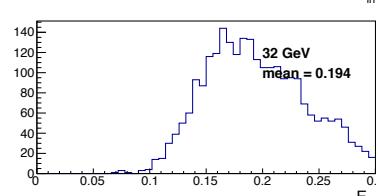
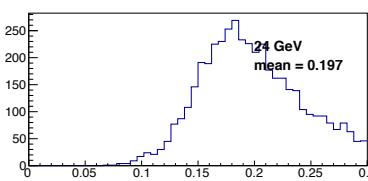
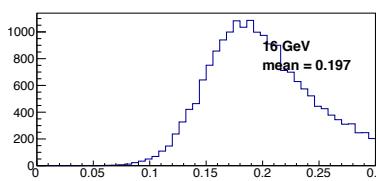
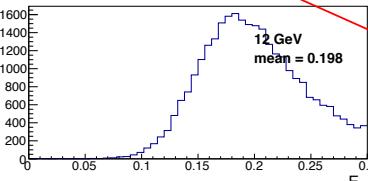
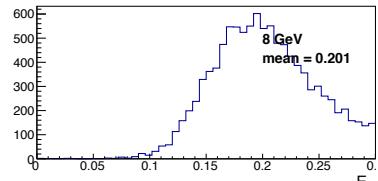
Use stand-alone HCAL runs:

- Negative beam 3721-3732

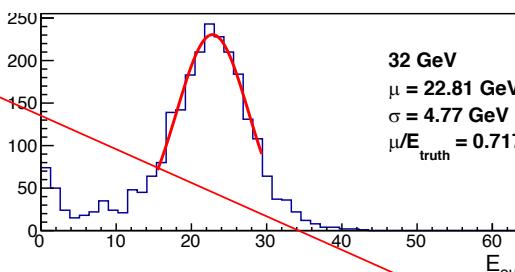
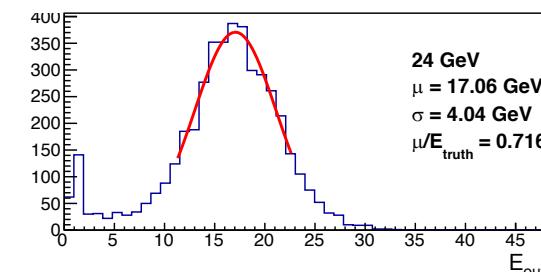
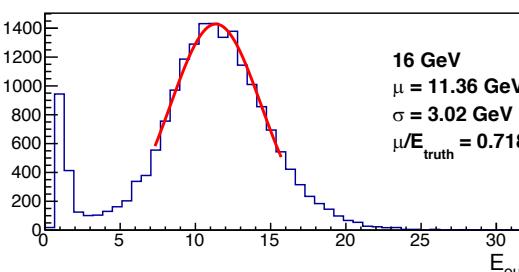
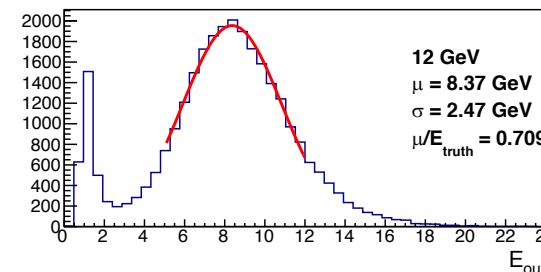
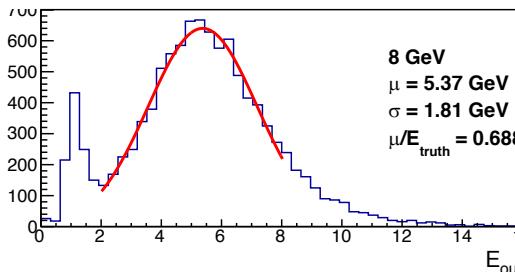
Select hadrons with  
Cherenkov1 < 5

Select events in MIP distribution in  
the inner HCAL (shown below)  
 $E_{\text{hcalin}} < 0.3$

Take average MIP energy left in the  
inner HCAL to be **0.198 GeV**

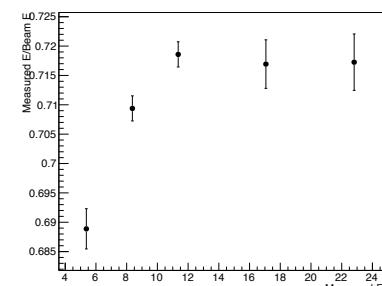


Outer HCAL energy distribution for MIP inner HCAL



Plot:  $(\text{mean of fit}) / (E_{\text{beam}} - 0.198)$

For now take the value **0.72**



# Calibrate outer HCAL

Use stand-alone HCAL runs:

- Negative beam 3721-3732

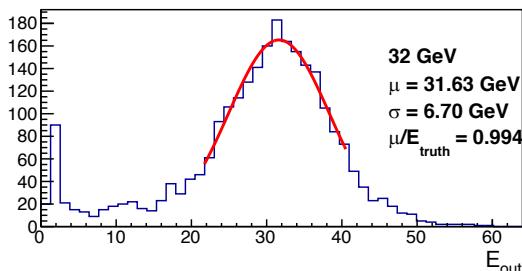
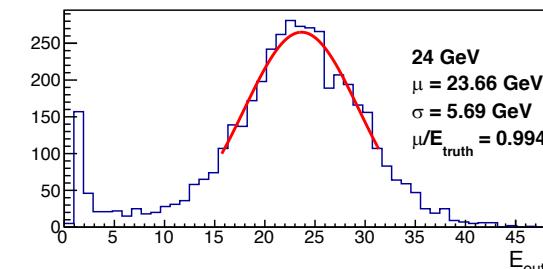
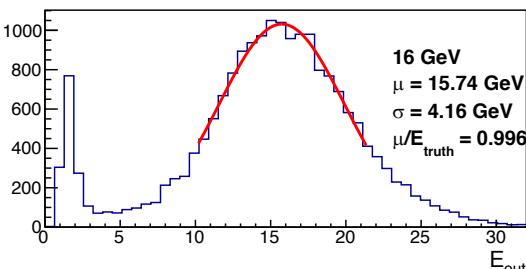
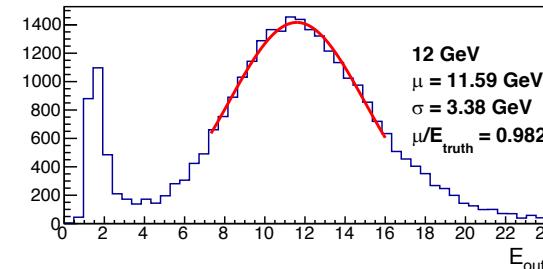
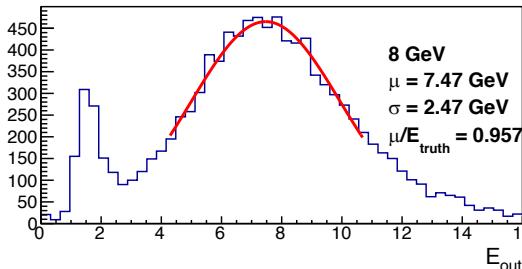
Select hadrons with  
Cherenkov1 < 5

Select events in MIP distribution in  
the inner HCAL  
 $E_{\text{hcalin}} < 0.3$

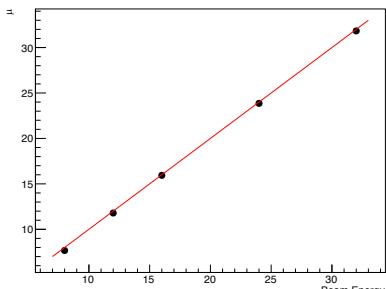
Take average MIP energy left in the  
inner HCAL to be **0.198 GeV**

Outer HCAL energy scaled by  
correction factor obtained on the  
previous page **0.72**

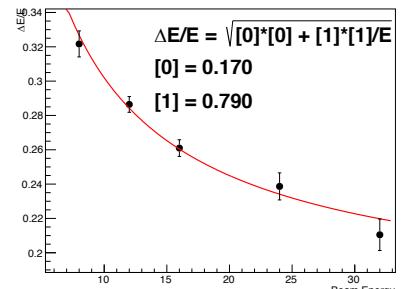
**Corrected Outer HCAL energy distribution**



Linearity



Resolution



# Calibrate inner HCAL

Use stand-alone HCAL runs:

- Negative beam 3721-3732

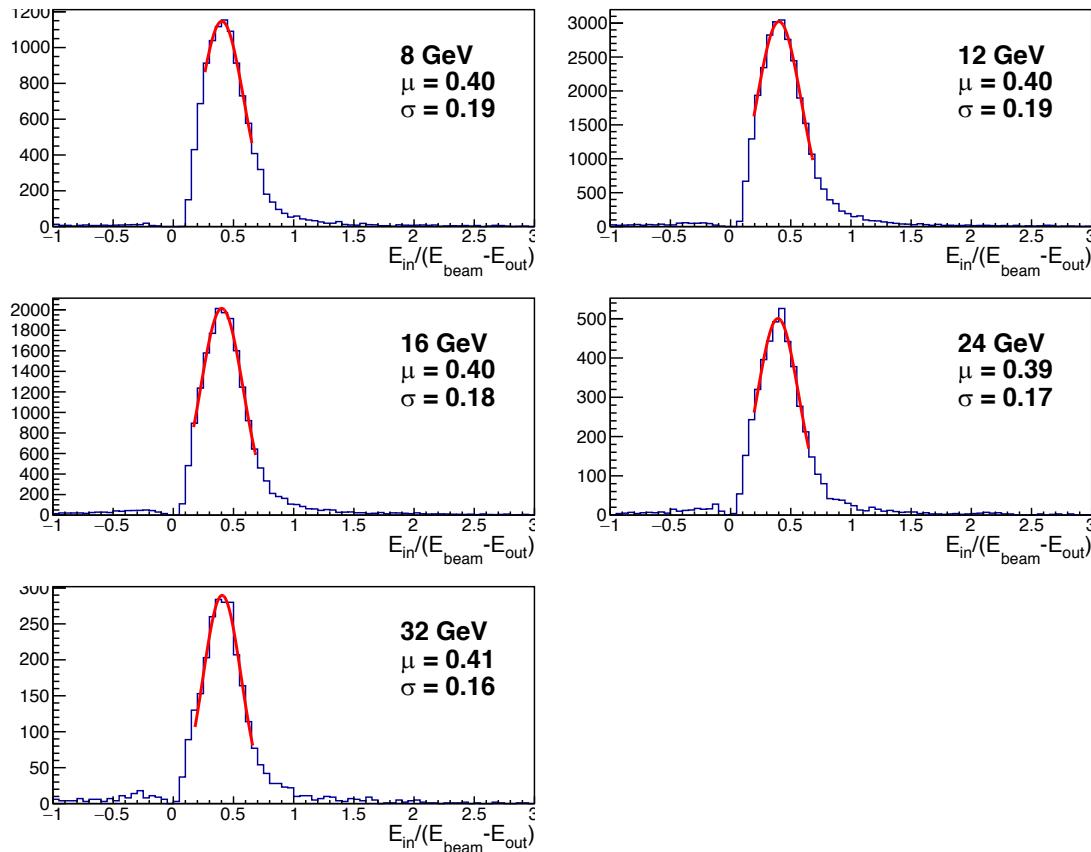
Select hadrons with  
Cherenkov1 < 5

Select events **not** in MIP distribution  
in the inner HCAL  
 $E_{\text{hcalin}} > 0.8 \text{ GeV}$

Plot  $E_{\text{hcalin}} / (E_{\text{beam}} - E_{\text{hcalout}})$  with the  
corrected HCAL out energy

Take the inner HCAL correction  
factor to be **0.4**

Correction factors for inner HCAL



# Stand-alone HCAL Calibration Validation

Use stand-alone HCAL runs:

- Negative beam 3721-3732

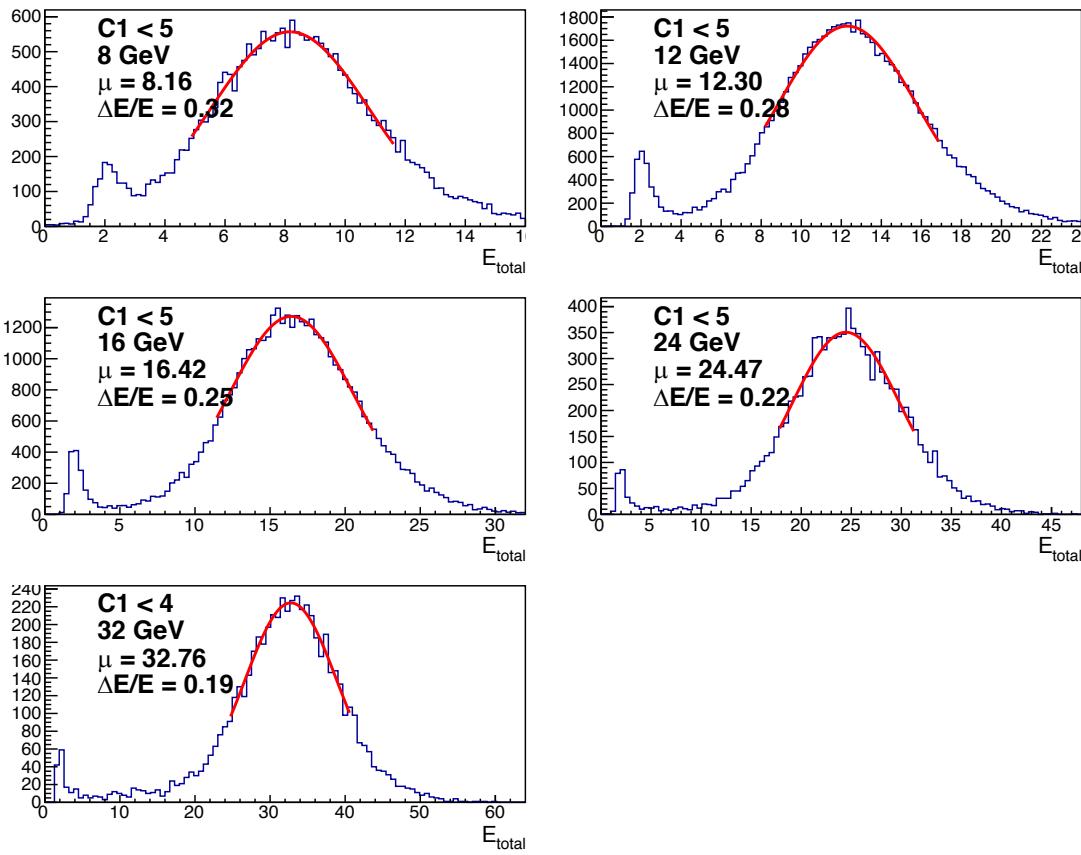
Select hadrons with  
Cherenkov1 < 5

Plotted is the sum of the corrected energy in the inner an outer hcals  
with correction factors of:

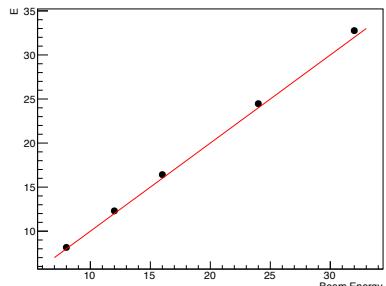
HCAL<sub>in</sub>: 0.4

HCAL<sub>out</sub>: 0.72

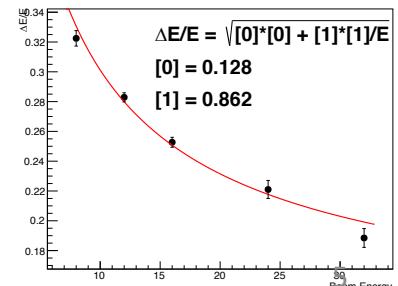
This is not perfect, but let's go with it  
for now



Linearity



Resolution



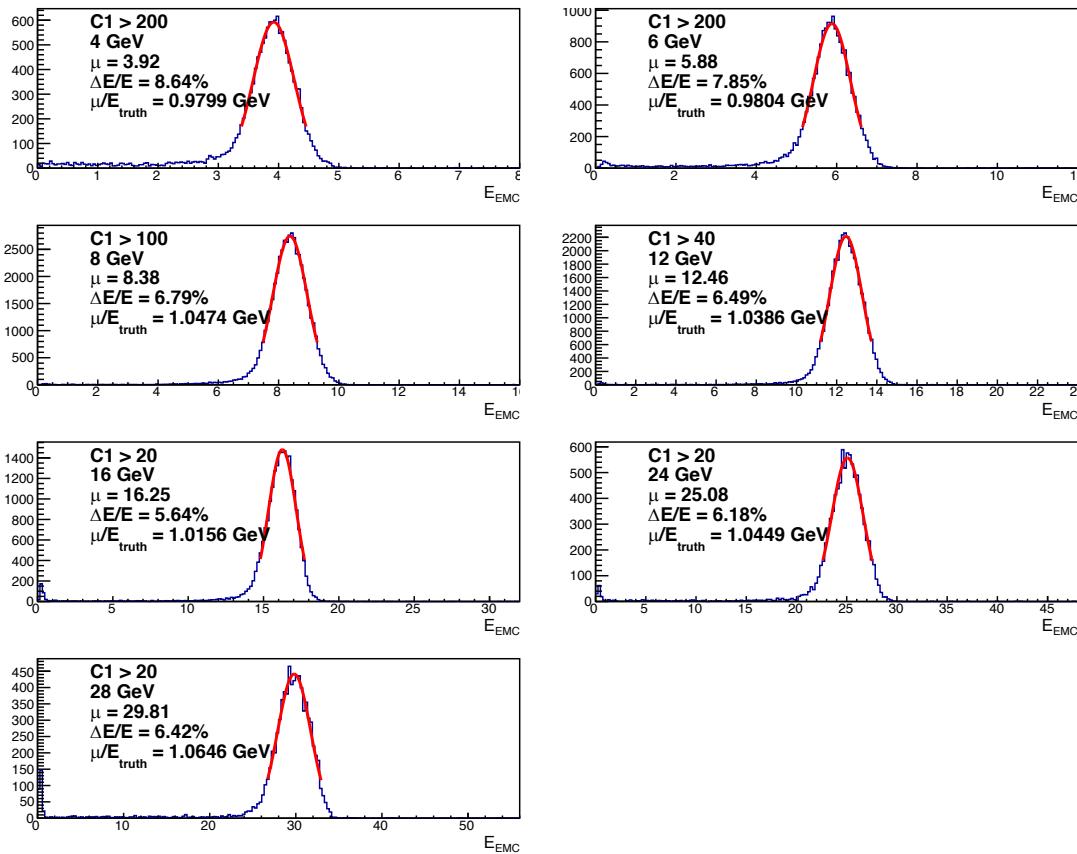
# Joint ES1 – electron EMCal Calibration

Use joint ES1 runs:

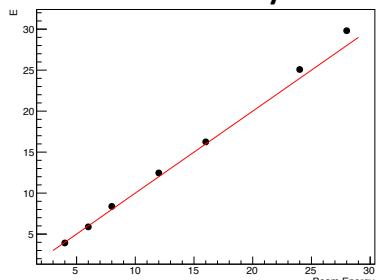
- Negative beam 3736-3751

Select electrons with  
Cherenkov1 > 250-20 (dep on energy)

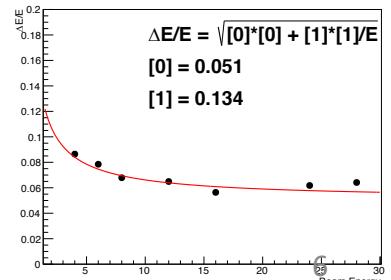
Electrons look reasonable and fairly  
well calibrated



## Linearity



## Resolution



# Joint ES1 – hadron EMC Cal Calibration

Use joint ES1 runs:

- Negative beam 3736-3751

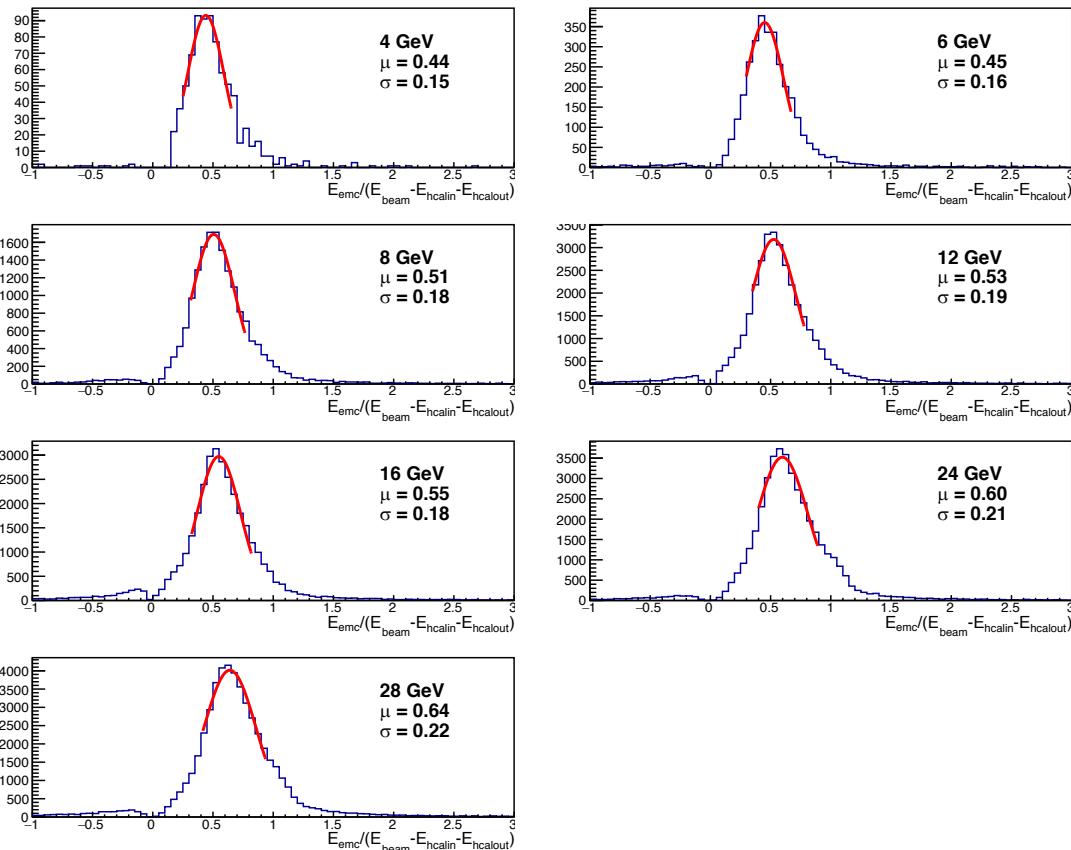
Select hadrons with  
Cherenkov1 < 5

Use calibrations for inner and outer  
HCAL from stand alone study in the  
previous slides

Similar to calibrating the HCAL<sub>in</sub>, select  
events **not** in MIP distribution in the  
EMC  $E_{\text{emc}} > 0.5 \text{ GeV}$

Plot  $E_{\text{emc}} / (E_{\text{beam}} - E_{\text{hcalout}} - E_{\text{hcalin}})$

Take the hadron EMC correction factor  
to be **0.5**



Means steadily rising with beam energy?

# Joint ES1 – total hadron resolution

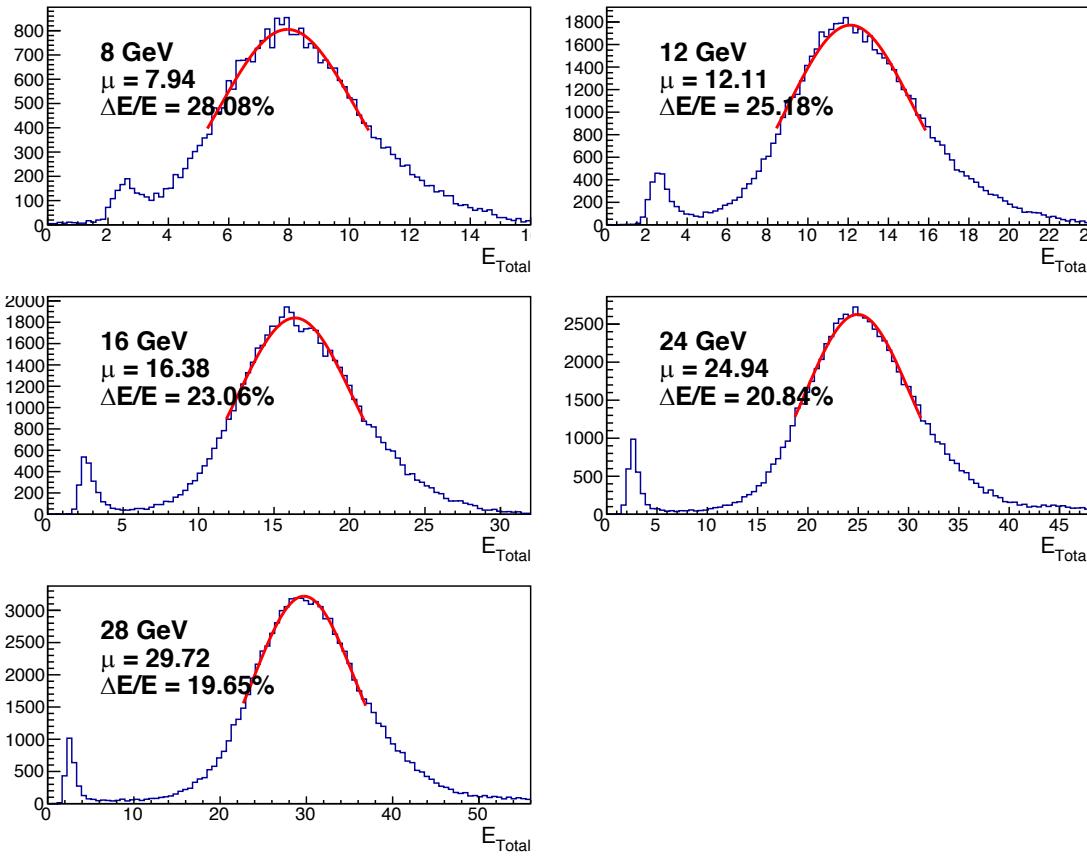
Use joint ES1 runs:

- Negative beam 3736-3751

Select hadrons with  
Cherenkov1 < 5

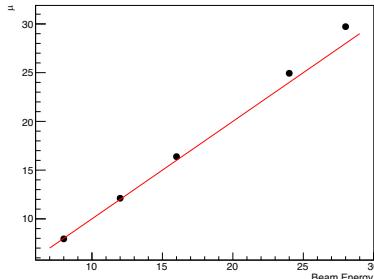
Use calibrations for inner and outer  
HCAL from stand alone study

Use calibration for EMC from previous  
slide

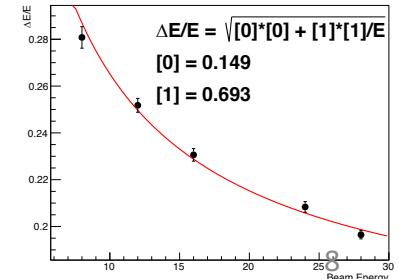


Can't fix linearity with  
constant scale factor

Linearity



Resolution



# Joint ES1 – hadron resolution summary

Overlay plots summarizing hadron linearity and resolution from previous slides

	HCal out	Hcal total	Total Cal
[0]	0.17	0.128	0.149
[1]	0.79	0.862	0.693

